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Grape Growing in Oregon

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The regular bulletins of the Station are sent free to the residents of Oregon who request them.

SUMMARY

Plant grapes on a sloping elevation to escape frost.

The soil should be deep and well drained with a reasonable amount of fertility.

Use manures in preference to commercial fertilizers.

In the cooler districts plant American grapes mostly, of which the Campbell's Early is the best.

In districts planting European grapes the Flame Tokay is one of the best varieties to grow.

During the first three years develop the framework of the vine.

Prune according to the strength and vigor of each individual plant.

In order to obtain the best quality, allow fruit to color and ripen well before picking.

Pick when the berries are dry. Handle as little as possible.

Mildew can be controlled by dusting. Phylloxera is controlled by using resistant stocks.

Grape Growing in Oregon

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LOCATION

Slope. Grapes must be grown in a location as frost-free as possible. The best locations are on slopes at least fifty to one hundred feet above the valley floor. The slopes below the grape plantings should be open and clear to allow the cold air to drain away to the lower levels where the frost and freezing are more apt to occur. An elevation of this height will ordinarily protect the grapes from the lighter freezes or frosts. Frosts that will not damage other fruits will kill back the young shoots of the grapes, thus destroying the possibility of a crop for that season; for though a light second crop may come on later in the season, it seldom matures well. A north slope will tend to delay the buds in the spring, while a southern slope may force them out earlier. During the summer season the southern slope will be warmer, a fact which is generally beneficial as grapes require a considerable amount of heat. Since a southern slope will not only bring the buds out earlier in the season but will keep the vines warmer throughout the whole summer, grapes should, under usual conditions, develop better quality and a higher sugar content in such a location than where they are planted on a northern and consequently a cooler slope.

Soil. The soil for grapes should be deep. By this is meant a minimum depth of four feet and preferably from five to six feet. It is not necessary that the lower soil should be of the same texture as the upper, but it must be open and porous. The grape roots will naturally run deep and if the soil is open and porous it will be found that the grapes develop better as a consequence. The richest soils are not as well adapted to grapes as the less fertile soils, too much available plant food tending to encourage a rank vegetative growth at the expense of fruit production. On the other hand, soils that are worn out or naturally deficient in plant food are equally unsuitable because the growth will be sparse and weak. Many different types or classes of soils, however, meet these foregoing requirements, and good grapes can be grown on them.

Drainage. Good drainage is essential as grapes will not tolerate any considerable amount of standing water. Vines growing in water-logged soils are invariably weak, yielding poor crops and succumbing more readily to attacks of insects and diseases. If the location is chosen with reference to air drainage, the soil drainage is usually taken care of, with the exception of cases like seepage spots that are frequently found on hillsides. If the soil that has been chosen for grapes is well drained both as to air and water and possesses a moderate degree of fertility, it will grow grapes well whether of the very light type or grading off to the heavier types.

MAINTAINING THE SOIL

For best results the soil should not be cropped steadily for years without returning to it in some form or other approximately the same amount of plant food that has been taken out by the crops. Unless this is done, the supply of plant food will be gradually depleted and some form of plant food will become exhausted before the grower is aware of it. Consistent methods of returning plant foods to the soil should be carried on throughout the life of the planting.

Commercial Fertilizers. Determination by chemical analysis of what plant foods are necessary or what plant foods are missing in a soil is not feasible in most cases. It has been found in many instances that while a certain plant food element may be present in large amounts it exists in some chemical combination which renders it to a considerable degree unavailable to the plants. A chemical test, while showing that this plant food was present in sufficient amount, would not show that it was in an unavailable form, so the test would be of little or no value to the grower seeking to determine what fertilizers or plant foods to add to his soil. A plant food present in the least amount might be readily available and supply all of that element necessary to plant growth.

Each soil is a problem in itself, for no one fertilizer can be recommended for grapes under all conditions. If a planting shows that something is missing in the soil and it is necessary to apply a commercial fertilizer the grower should test out several kinds before applying any to his whole planting unless he is reasonably sure as to what is needed in the soil.

Nitrogen can be supplied by nitrate of soda at the rate of two to three hundred pounds per acre. Phosphorus is supplied by superphosphate at the rate of four hundred pounds per acre, while potassium can be supplied by muriate or sulfate of potash at the rate of one to two hundred pounds per acre. In the greater number of cases nitrogen is missing in the soil and nitrate of soda is the most beneficial, but this can only be determined by testing out the different kinds of fertilizers. For testing out it is advisable to use small plots of an eighth or tenth of an acre, fertilizers being applied to these small plots at the rates suggested per acre. They should be used alone and in combination. Under most conditions lack of any plant food can be detected by this method.

The use of a complete fertilizer is generally not profitable. It is a waste of money and effort to apply a certain plant food element if there is a sufficient supply of that element in the soil, which is what is done when we use the complete fertilizer unless it should happen to be a case where the soil is run down in two or three plant food elements. After the suggested tests show what plant foods are necessary, the whole planting can be treated by the one fertilizer that has shown the best results.

Time of Application. In most places fertilizers should be applied early in the spring about three to four weeks before growth starts, so that the rains will liberate the plant food for use by the roots early in the season. In irrigated sections, of course, the plant food or fertilizers can be applied whenever needed.

Lime. As in the case of all our fruits, the use of lime with grapes has never yet paid for its application. Where the soils are properly drained and of the right type, we usually do not find them so sour or acid that they

need sweetening by the use of lime. On the contrary, we may find that lime will cause conditions in the soil to which grapes are not suited, the grape like our other fruits doing better in a soil that is slightly acid.

Manures. As a general rule, if we have the soil full of humus from manures and cover crops, we have solved the question of soil fertility. Humus fulfills a threefold function. First and foremost, it increases the water-holding content of the soil. Second, as decomposition takes place it supplies plant food. Third, its presence and decomposition enable bacteria and chemical action to be carried on at an accelerated rate so that the supply of available plant food is increased. The maintaining of an extensive supply of humus in the soil is often a serious problem and one very difficult to handle properly. It is the one big question before the grower today, as on the one hand the supply of manure is rather limited and on the other hand the growing of cover crops is frequently difficult.

Barnyard Manure Beneficial. The use of barnyard manure is nearly always beneficial. Seldom do we find a soil in which an over supply of manure has stimulated excessive vegetative growth. Cover crops serve the same purpose as manure, especially if leguminous crops are used, such as vetch, by which the nitrogen content of the soil will be increased. Combinations of oats and vetch or barley and vetch are generally used. These should be planted early in the fall to obtain an early fall growth before the colder weather of the winter. The crop should be plowed under early in the spring before it becomes at all woody. Any amount of woody or strawy material that is plowed under uses up a considerable amount of moisture, as moisture is necessary in the decay of strawy materials. The amount of moisture thus lost is often sufficient to be detrimental to the growth of vines or plants. It is quite frequently a problem to obtain sufficient growth before time to plow under and yet not delay the plowing until too late in the season. Careful study of this problem is needed on the part of growers according to their own local conditions.

Cultivation. The aim in cultivation should be to begin early in the spring and continue at frequent intervals throughout the season until late summer. Usually it is advisable to plow early in the spring so as to warm up the soil for early activity of the plants. Many growers find it of advantage to plow toward the vines in the fall and away from the vines in the spring. If such a practice is followed, it is very easy to clean out the weed growth by the use of the grape hoe. If one has a sufficient acreage of grapes, or grapes and brambles, the use of this implement quickly pays for itself. After plowing in the spring disking is usually advisable, followed by some form of harrow to form a dust mulch. The harrow should be used often enough to prevent the formation of a crust and to develop a dust mulch that will stop the evaporation of the soil moisture.

PROPAGATION

Most of the grapes are propagated by cuttings except where it is necessary to graft onto resistant stock to give immunity to the phylloxera.

Cuttings. Cuttings are best taken in the fall immediately after the leaves fall. At this time there is a greater amount of plant food stored up in the canes, insuring greater strength to the cuttings in forming callus and in putting out roots. Cuttings can be made, however, at almost any

time until the buds break, but later cuttings are not rooted as easily as the earlier cuttings. Healthy, vigorous wood, one year old, of medium size is used; that is, the wood grown the previous summer. Cuttings are usually three nodes or three buds long, though they can be of one or two buds in length if wood is very scarce. The lower cut is made just below the bud, where the roots will develop most freely. The upper cut is made about an inch above the upper bud, as this will allow of a little drying out of the tissue without injuring the bud.

Care of Cuttings. After cutting, the pieces can be tied in bunches of twenty-five or fifty and stored in sand until spring. If they can be placed butt end up three to five inches below the surface of the ground in a warm, sunny spot they will become callus more readily. Early in the spring, as soon as the soil is fit to work, cuttings can be planted in rows at convenient distances for cultivation. In the rows the cuttings can be spaced from three to six inches apart. These plants should be ready for transplanting at the end of the first year. In case a variety roots with difficulty it has been found that the hammer cutting gives greater chances of root development. Such cuttings are made with an inch and a half or two inches of the two-year-old wood at the base of the cutting, thus forming a hammer-like effect, only one cutting being made from a cane. They are handled at the same time and in the same way as other cuttings.

PLANTING

Time of Planting. Planting should be done early. In transplanting, most of the roots and root hairs will be torn off and the plant forced to send out a new growth. A certain amount of root growth is carried on throughout the winter season, so the earlier the plant is set the better developed its root system will be by the time the buds open and growth begins. If transplanting is delayed until late in the season, a large part of the strength of the plant will have been lost in the early root growth and, in addition, it will be too late for the roots to become well established before the hot, dry weather of summer is on. If by summer the roots have not grown through enough soil to furnish the moisture needed by the plant, the hot, dry weather will cause such a heavy evaporation through the leaves that a severe drain will be felt by the poorly established roots.

Protection for the Roots. In any of the operations connected with transplanting the plants, either in opening up the bundles, heeling in, or carrying to the field, the roots should not be allowed to dry out. They must be kept moist either by dipping in water and puddling in mud or by covering with wet burlap. If the grape plants have roots of any size, the roots should be shortened to three to six inches in length. Rough ends need to be recut to leave a smooth surface, though particular care need not be taken to preserve the very fine fibrous roots, which are very likely in any case to be damaged in planting. New rootlets will be put out by the roots to carry the root hairs that absorb the moisture and plant food.

At the same time that the roots are cut back the tops should be shortened to two buds in order to balance up the loss of the root systems suffered by the plants.

Method of Planting. Grapes are usually planted eight feet square as a minimum distance. Sometimes they are planted eight by nine or eight by ten with eight feet as the distance between the rows and the nine or ten feet as the distance between plants in the rows. This will depend somewhat upon the type of soil as to whether or not it will produce large, vigorous vines. Varieties also vary in their vegetative vigor and consequently as to the distance apart to be planted.

In staking out the field, it is usually advisable to run at least two base lines, so that the planting can be started out accurately. After the two base lines are run, other lines may be put through the field and then the stakes set by means of a wire marked at intervals as needed by the planting. On the other hand, after the two lines are established, sighting may be used, but in either method three men will be necessary in order to set the stakes efficiently and quickly.

When it comes to setting the plants the hole is dug a trifle larger than the expanse of the roots. As a rule an ordinary shovel will dig a hole large enough on one side with one cutting. The plants are placed in the hole at the depth at which they grew in the nursery. Fine earth placed around the roots and firmly packed down is far better than coarse lumps or clods of earth loosely thrown in, as the fine earth will sift in around the roots, shutting out all air. Air pockets around the roots are almost fatal to the life of the roots, as the roots readily dry out in such places. After the earth has been well packed down to a depth of several inches, the top inch or two is left loose. This avoids packing and baking later in the season, thus preventing rapid evaporation of the moisture directly around the plants. If the stakes are reset by the side of the little vine, it will be a considerable aid in cultivation as the vine itself at this time is only two buds in height, making it rather difficult to locate when cultivating.

VARIETIES OF GRAPES

The varieties of grapes grown in Oregon are to be found in two groups: first the American grapes, especially the Vitis labrusca and its hybrids; and, second, the European grapes, or Vitis vinifera.

The American varieties are hardier than the European varieties in their resistance to climatic conditions. The American grapes, having been developed in cooler climates, require less total amount of heat during the summer than do the European grapes. European grapes, excepting the very earliest ripening varieties, will not mature in the same cool climate where American grapes will develop to perfection. American grapes can be grown in any section where grapes can be grown in Oregon, while European grapes generally grow in only a few of the warmer, better favored sections. Only the very earliest of these European varieties can be grown in the cooler sections of the state.

In districts like the Willamette Valley the choice of varieties is restricted almost altogether to American grapes, or to the earlier European varieties. In districts like The Dalles, the Umpqua Valley, or the Rogue River Valley the European grapes can be grown to a certain extent provided they are not later in maturing than the late mid-season grapes grown in California. In those districts proved to be adapted to European grapes only a few better varieties of table grapes are likely to be profitable over a period of years. Grapes so grown will find even then only a local market, to provide certain varieties in season later than those same varieties which

come in from California. Even with the high transportation charges the certainty of a crop and the heavy yields of California vineyards place the grower in Oregon under a handicap. Growers in Oregon must expect greater chances of destruction of crops from fall rains, mildew, etc., than do the growers of the same varieties in the South.

For Cooler Sections. For commercial plantings in the cooler districts the Campbell's Early can be recommended as the leading variety. Of next importance will be the Concord, followed by the Niagara. For home use the Campbell's Early will again rank first followed by the Worden, Niagara and Agawam. The Worden and Agawam, while very desirable in quality, have other characteristics less suitable for commercial plantings. For those desiring a European variety the Sweetwater is the best for the cooler sections. The Chasselas Rose Royal has not been tested very extensively, but it gives very good promise of a red or pink variety to go with the Sweetwater. Either of these varieties, though not firm enough for any considerable shipping, is satisfactory for home use or a distinctly local trade. The quality is inferior to that of the better European table grapes, but these varieties are desirable because they rate as the earliest of the European grapes and from that standpoint are valuable in the cooler districts. The Muscat Hamburg and the Rose of Peru have been reported to do fairly well in several sections, but these can be expected to reach good quality only at times. Other varieties have been reported as doing moderately well in some places. The growing of European grapes in any but the best favored sections is not a commercial business, however, and for home use is only for those that like to test out things for themselves.

For Warmer Districts. For districts growing the European grapes commercially, the Flame Tokay is a proved variety and should be the one to be considered first. The others mentioned are to be considered as supplementary to this variety.

DESCRIPTION OF VARIETIES

The terms used in the description of American grapes apply only to the American grapes. The term "large," for instance, will not be applicable if used to compare the American with the European grapes, but is used in comparison of one American variety with another. The same will apply to the descriptions given of the European varieties.

AMERICAN VARIETIES

The Agawam. Vines fairly hardy, slightly subject to mildew; bearing only medium heavy clusters; large, but often poorly formed. Berries round, red, large, covered with persistent bloom, skin tough. Quality good. Mid-season, a little later than the Concord. Keeps very well in storage and the flavor seems to improve slightly at first.

Campbell's Early (Syn. Island Belle). Vines vigorous, hardy, very productive. Clusters variable, from medium to large, compact. Berries medium to large, roundish, dull dark or purplish black with heavy blue bloom. Skin tough, does not crack easily. Quality excellent. Season, early to mid-season. Becomes marketable early, but will hang on the vine and improve in quality over a considerable time; ten days to two weeks

ahead of the Concord. Will stand handling and shipping well on account of the tough skin. Keeps well in storage.

Concord. Vine hardy, vigorous, productive. Bunches uniform, large, and compact. Berries large, roundish, black with blue bloom. Skin average toughness, will crack during rain. Quality good. Mid-season. In many places fails to ripen as well as it should. An old standard variety comprising the biggest part of the plantings in the East, but on the Station's ground at Corvallis the Campbell's Early has surpassed it in excellence. This variety is about the latest variety that can be grown and matured in districts like the Willamette Valley.

Delaware. Vine not as a rule vigorous in growth, although in some heavy soils it tends to make vegetative growth at the expense of fruit production; always very hardy and productive; slightly subject to mildew. Bunches small and compact. Berries small, roundish, quite red, thin lilac-colored bloom. Skin thin, moderately tough. Quality excellent. Season, early, a little later than the Campbell's Early. This variety usually bears too light a crop of small grapes to be considered a commercial variety, but it is excellent for home use.

Niagara. Vine fairly vigorous, less hardy than the Concord, productive, slightly subject to mildew. Bunches large, fairly compact. Berries large, yellowish green, thin, gray bloom. Skin tender, but does not crack as easily as the Concord. Quality excellent. Mid-season, about with the Concord. The best green or white grape among the American grapes.

Worden. Vine vigorous, hardy, productive. Bunches large, compact. Berries dark purplish to black. Heavy blue bloom. Skin tender, cracks badly. Quality excellent. Season, early to mid-season; ripens between Campbell's Early and Concord. Probably best quality of the black grapes, but skin is so tender and the keeping quality so poor that the Campbell's Early supplants it for commercial plantings.

EUROPEAN GRAPES

EARLY VARIETIES

Chasselas Rose Royal. Similar to the Sweetwater except as to color of the fruit, which is a delicate pink or light red.

Chasselas Rouge. Similar to Chasselas Rose Royal except a week later.

Sweetwater. Vines vigorous, hardy for this group, somewhat affected by mildew, productive. Bunches medium sized, compact. Berries medium to large size, yellowish green, slightly affected by rain. Quality good. Season, a little later than the Concord. This has been the most successful European grape tested at the Station grounds and one of the very few that can be generally grown in the Willamette Valley or in similar locations.

MID-SEASON VARIETIES

Muscat Hamburg. Clusters very large. Berries variable, small to large roundish, moderately firm, dull, dark color. Of a distinct Muscat flavor. Early to mid-season. Generally considered too soft for shipping any great distance.

Rose of Peru. Clusters large, compact. Berries large, round reddish black, firm. Early mid-season. Reported as doing well in some sections.

Flame Tokay. Clusters large, very compact. Berries large, firm, red color. Late mid-season. Best commercial grape for those sections in Oregon growing European grapes.

PRUNING AND TRAINING AMERICAN GRAPES

The pruning of the plants at the time of planting has been treated previously. After the first season, all canes except the strongest one that grew the first season are cut off. The one cane is again cut back to two buds. This may seem to be a drastic treatment, but is done to develop a vigorous root system and at the same time prevent the cane from bearing. If a long cane should be left there would be a possibility of the vine bearing, and bearing at this time would be weakening and devitalizing to the vine. It should become well established before being allowed to bear.

Both buds will undoubtedly put out canes and both should be allowed to develop. If only one is allowed to grow an accident may remove the rather tender growth and the plant be set back a year. Canes coming from adventitious buds are best removed as fast as they appear.

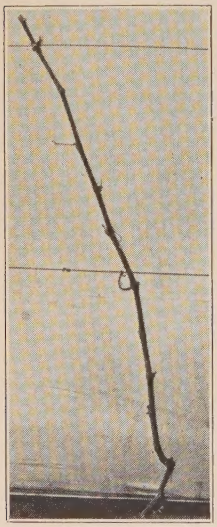

Fig. 1 Grape-vine at the beginning of the third season. Pruned and trained to two-wire trellis.

At the beginning of the third season the permanent trunk of the vine is formed. The strongest and best cane should be selected, cutting away the others. The height at which it should be cut off depends upon the method of training to be used. As a general rule American grapes are grown on some form of trellis, and the cane should be cut off at a point a little above the buds from which the upper fruiting canes are desired to spread horizontally (Fig. 1). Since there will be a wire at this point, the cane is cut one or two inches above the wire and tied firmly to the wire. The part above the wire will, in time, be killed by the stricture of the tie.

Pruning the Bearing Vines. Grapes are formed laterally on the current season's growth arising from buds on one-year-old wood, one to four bunches ordinarily forming to a shoot. Not all buds on one-year-old wood are capable of fruit production. The external appearance of all buds is similar but much can be told as to position on the vine or cane. Buds on one-year-old wood arising from two-year-old wood have a greater possibility as to fruit bearing. Canes coming from the older wood are very likely to have only wood buds that develop non-bearing shoots, so suckers or water sprouts are very apt to be sterile. On canes bearing fruiting buds the first bud or two is likely to be sterile, though the buds beyond these first sterile ones will be fruitful out to the wood that is not well matured or not well formed.

Pruning the bearing grape vine is in reality a thinning out or a cutting off of these fruit buds to prevent over-production. If all the fruit buds were allowed to remain and to put out fruit-bearing shoots the vine would

set a much greater amount of fruit than it could possibly mature. A vine that is overloaded produces small, poorly formed bunches of fruit and makes a weak growth so that it will be devitalized for the next season's crop. The large, compact, and well formed bunches are found on those vines making a vigorous vegetative growth, and the total yield will be as great or greater than from a vine with a large number of small bunches. On the other hand too severe a thinning or pruning may result in excess vegetative growth and little fruit. Pruning with proper cultural practices should be such that a vine will set a moderate number of bunches and at the same time make a good growth.

Proper pruning of the normal vine will result in the removal of at least 90 percent of the one-year-old wood, a heavier pruning than is ordinarily given any other fruit. The amount of wood or buds left is determined by the condition of the plant. A young vine will be able to support a smaller number of buds than an older vine. The mature vine that is making a good growth should have the same number of buds left that was left the previous season, while a vine that is weakened and did not do well the past season should be pruned heavier than it had been before. On the other hand, the vines that are making a very vigorous growth should not be pruned so heavily and should be allowed to devote more of their energy to fruit production.

A mature vine is expected to have about thirty fruit buds. This number will produce from forty to sixty bunches. After the number of buds has been determined for each vine, the canes are then to be selected that will carry the buds. Use well-formed, vigorous bearing canes with buds at moderate distances apart. Canes larger than the average and with buds a considerable distance apart are very frequently sterile.

Training. Training depends upon the type of trellis to be used. On the type of trellis and the kind of training used will depend the number of canes to be left and their distribution. American grapes are generally pruned to the long cane system and supported by some kind of wire trellis. Many different systems are used but only two will be described which are commonly in use and not only economical to handle but satisfactory in the results obtained.

Kniffen System. The four-arm Kniffen system is one of the most commonly used methods of training grapes. While it is claimed by many not to be so good as others, it is the easiest and cheapest way of training grapes. The trellis consists of two wires on posts as with the ordinary berry trellis, with posts thirty-two to thirty-six feet apart and wires two and one-half and four and one-half feet from the ground. As described under the pruning of the young vines, the main stalk or trunk is tied to the upper wire. In the pruning for the fourth season, four of the best canes are selected to be left, two as near the upper wire as possible and the other two nearer the lower wire. Two canes are trained along each wire, one running each way from the main stalk (Fig. 2). This year there ought to be from five to six buds to each cane, counting the sterile basal buds. Each year after this the number of buds left can be increased until the full number is reached, the increase depending upon the vigor of the vine and continuing until the balance between the amount of fruit production and vegetative growth is reached.

In the later development of the vine the buds nearer the outer ends of the canes often form more vigorous shoots or canes and in time the fruiting wood will be at a considerable distance from the trunk unless steps are taken to avoid it. Suckers or water sprouts are generally found coming from adventitious buds on the trunk or older wood of the arms. If these sterile canes are cut back to one or two buds, the renewal

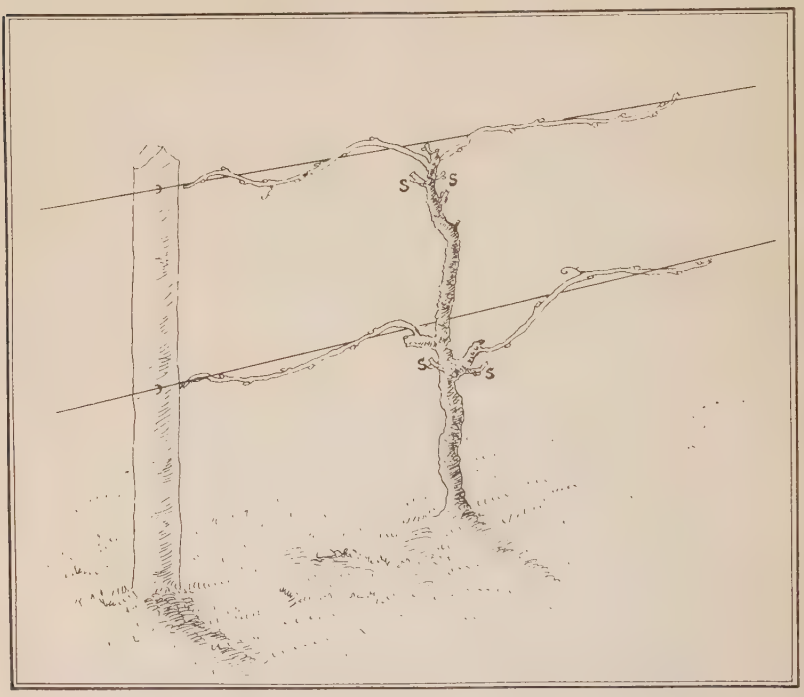

Fig. 2. Four-arm Kniffen System. S, renewal spurs.

spurs (Fig. 2) thus formed will the following year produce canes that will have good fruiting buds on them. By looking forward a year in the pruning the location of fruiting canes can be controlled on most vines.

Munson System. In the Munson system of training grapes, a three-wire trellis is used. The lower wire is about forty-two inches from the ground and fastened to the posts the same as with the Kniffen system. At the top of the four and one-half foot post is a two by four crosspiece eighteen to twenty-four inches long. At each end is fastened one of the other two wires of the trellis. The main stalk of the grapevine is trained up to and tied to the lower wire. The arms or canes are then trained along this wire using two or four canes (Fig. 3.) The number of buds left is dependent upon the same conditions as for the Kniffen system. After the new shoots start developing they will grow erect for a short time, then droop down and in most cases lie over one of the upper wires. A very

little work by the grower will put all shoots in this position. With the shoots drooping over the upper wire the bunches of grapes hang free on the lower side of the vine (Fig. 4). This renders circulation of air freer among the bunches so that development of disease is less likely to occur during wet weather, and also the bunches are not entwined by the growing shoots or tendrils of the vine. This renders picking much simpler and easier than with any system of vertical training and does away with many of the inferior bunches that are deformed or injured in removing from the canes when they are twisted or entwined with the tendrils of the canes or with the canes themselves. This system is a little more expensive to install, but the ease of picking and the freedom from the poor bunches soon pay for the extra expense. This system, as developed in Texas, aimed to afford greater protection to the grapes from the direct hot rays of the sun. So far as tried in this state it has worked equally well under all conditions, not so much from the standpoint of protection from the sun rays but in the production of perfect bunches and ease in handling.

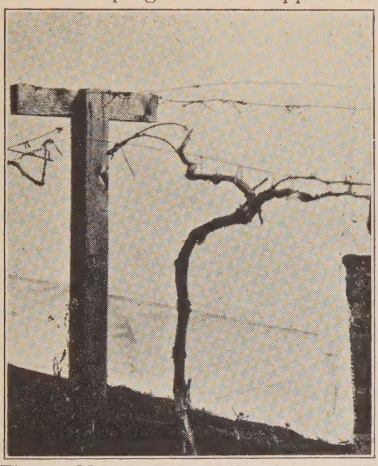

Fig. 3. Munson system of training trellis.

Fig. 4. A good crop of grapes hanging free on the under side of vines. Trained according to Munson system.

PRUNING EUROPEAN GRAPES

The pruning for the first two years is the same as outlined for American grapes. During the second season the vines are tied to a stake driven close to the vines, for although self-supporting when mature the trunk or stalk needs support while young. The upper tie should be made a little above where the head is to be formed, for the vine above the tie will droop and form a crook in the cane. The height of head varies from

twelve to twenty-four inches above the ground, frequently depending on climatic conditions. In sections of cold winters but heavy snowfall a low head gives protection against winter injury, but where mildew is bad a higher head gives better air circulation and better protection against this disease.

Fig. 5. Training European grapes by the short spur method.

In general, short spurs of two to three buds are used (Fig. 5). The varieties vary; some require the long spur method while others do best when trained as with the American grapes. The Sweetwater gave much heavier yields on the Experiment Station grounds when trained by the Munson system than when pruned to short spurs. The Thompson Seedless is regularly trained on a trellis in some districts. The other varieties, as the Flame Tokay, demand a short spur pruning, while the Malaga requires the half-long spur with from six to eight buds to a cane.

The number of buds will be determined as with the American grapes, except that the bunches of many European grapes will average two to three times the weight of the American grapes, and the number of buds left will be from one-third to one-half that left on the American grapes. Thus from eight to fifteen buds per vine, according to age, vigor, and size of the variety, will be sufficient to produce a crop. Usually from ten to twelve buds will be about the proper number for the mature vines.

Although the arms are more permanent than with the grapes trained on the trellis, provision must be made for renewal spurs. Before the arms become too long several sterile canes can be cut back to one or two buds that will produce bearing canes the coming season. As soon as this is developed the old arm can be cut back close to the new cane or new arm, thus shortening the head and holding it close in to avoid breakage.

Time of Pruning. Pruning can be done at any time following the first two weeks after the leaves fall. Pruning immediately after leaves fall causes a loss of plant food not yet transferred to the root system. Pruning late in the winter causes more bleeding as a rule than does early pruning. During the seasons 1921 and 1922, four rows of American grapes were pruned December 12, 1921, four rows were pruned March 13, 1922, and one row April 10, 1922. These were of mixed varieties, but some varieties were represented in all three classes. Observations made during the summer and fall could show no difference in time of leafing out, in the size of crop, or in the time of ripening. On the whole, early pruning is to be advised simply to avoid the loss of sap caused by late pruning.

RINGING AND GIRDLING

During 1921 girdling and ringing of the canes was carried on during July. These girdles were made between the first bunch and the base of the cane. This was carried on with the idea of stopping the downward flow of plant food and hastening the maturity of the grapes. On American grapes no results were visible. On European grapes it hastened maturity from a week to ten days. That season, only the early varieties of the European grapes matured well, but the practice brought on the early mid-season grapes well enough for picking rather late where part of the canes were girdled. The influence of girdling was such that the bunches on the girdled vines would turn color and become sweet approximately a week or ten days ahead of the bunches on the same vines that were not girdled. This was devitalizing to the canes on which this was carried out and invariably these canes had to be discarded entirely in the next season's pruning. This practice can not be considered practical from a commercial standpoint.

The same season bunches of grapes were enclosed in sacks with the idea of protection against weather conditions. The results were opposite to the expectations as the bunches enclosed in sacks were uniformly much inferior to those exposed. The sacks held the moisture and apparently kept the bunches much cooler so that the development of the bunches was poorer than that of the bunches that were exposed to the atmospheric conditions. The color had much less of a live appearance and the bunches seemed inclined to be less compact.

PICKING GRAPES

Grapes must be picked when entirely dry, for those that are picked while still moist will develop decay in a short time. The best time for picking grapes is during the heat of the day. Grapes are handled more easily when stems are slightly wilted and this will be more apt to occur during the middle of the day when the transpiration of moisture is most rapid. During the cool part of the day when the stems are turgid and rigid, shelling is much more apt to occur as the stem yields less to pressure. Especially is this the case with the American grapes.

In picking it is necessary to use clippers or shears as breaking the stems is too apt to bruise the berries. Leaving the stems long enough to grasp readily is an aid in handling the bunches, for the bloom should be undisturbed as much as possible. The appearance of a basket of grapes is enhanced by the appearance of fresh, undisturbed bloom on the grapes and this is possible only where the grapes are handled by the stems rather than by grasping the whole bunch. For picking, a receptacle like a shallow lug box is preferable to a deep one, in order to avoid bruising. After picking, also, it is frequently of advantage to allow the grapes to remain for a day to permit of wilting as this increases the ease of packing. The packages generally used for grapes are the grape baskets with four baskets to a crate or the shallow lug box.

INSECTS AND DISEASES

(Control Measures Recommended by Station Entomologist and Pathologist)

Of the diseases of grapes the powdery mildew (*Uncinula necator*) is the most destructive. This disease does more damage to the European varieties than to the American varieties although many of the American grapes are susceptible to it. It attacks all green parts of the vine. On the leaves and shoots the attack of the disease is shown by whitish or grayish white patches. Foliage and shoots so attacked have a stunted, wilted appearance. If attacked early, the berries will drop but if attacked later they will either develop in an irregular fashion, sometimes becoming dry or cracking open, or at other times being greatly reduced in size and quality, depending upon the severity of the attack.

The universal remedy is dusting the vines at intervals with sulfur. Sublimed sulfur of the finest grade, sold as flowers of sulfur, appears to be much superior for mildew control to even the best grades of ground sulfur of equal fineness. Begin dusting when new shoots are six to eight inches long and repeat as required. An application just before bloom is a good thing. Others should be given when inspection shows that the disease is present.

No insects are particularly bad in this state at the present time. One insect, the Phylloxera *(Phylloxera vastatrix)* should be guarded against, especially in those sections where European grapes are being grown. The American varieties and their hybrids have a greater resistance to this insect. The Phylloxera is a minute root louse that feeds on the plant juices. In large numbers it gives the roots the appearance of being dusted with a yellow powder. The only control for this insect is to use resistant stocks of which the Rupestris St. George is an example and one often used, though many commercial varieties demand the use of others of the resistant stocks. Unless a district is absolutely sure that no infected stock is being brought in, it would seem the wiser course to plant all Vitis vinifera on resistant stock. A leaf mite (*Eriophyes vitis*) has been reported several times. This mite causes a distortion of the upper surface of the leaf, the lower surface of the distortion, or gall, being covered with a mass of felty material giving it the name of the felty gall. This insect ought to be controlled by a spray of lime-sulfur just as the buds are opening out, though little definite data are at hand.